



TFT LCD Approval Specification

MODEL NO.: N173O6 - L02

Customer : ASUS

Approved by : _____

Note :

核准時間	部門	審核	角色	投票
2010-05-20 08:28:55	NB 產品管理處	<div>楊 2010.05.20 竣傑</div>	Director	Accept



- CONTENTS -

REVISION HISTORY	-----	3
1. GENERAL DESCRIPTION	-----	4
1.1 OVERVIEW		
1.2 FEATURES		
1.3 APPLICATION		
1.4 GENERAL SPECIFICATIONS		
1.5 MECHANICAL SPECIFICATIONS		
2. ABSOLUTE MAXIMUM RATINGS	-----	5
2.1 ABSOLUTE RATINGS OF ENVIRONMENT		
2.2 ELECTRICAL ABSOLUTE RATINGS		
2.2.1 TFT LCD MODULE		
2.2.2 BACKLIGHT UNIT		
3. ELECTRICAL CHARACTERISTICS	-----	8
3.1 TFT LCD MODULE		
3.2 BACKLIGHT UNIT		
4. BLOCK DIAGRAM	-----	11
4.1 TFT LCD MODULE		
5. INPUT TERMINAL PIN ASSIGNMENT	-----	12
5.1 TFT LCD MODULE		
5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL		
5.3 COLOR DATA INPUT ASSIGNMENT		
5.4 EDID CODE DATA STRUCTURE		
6. Inverter Specification	-----	18
6.1 ABSOLUTE MAXIMUM RATINGS		
6.2 RECOMMENDED OPERATING RATINGS		
6.3 LED BACKLIGHT CONTROLL POWER SEQUENCE		
7. INTERFACE TIMING	-----	20
7.1 INPUT SIGNAL TIMING SPECIFICATIONS		
7.2 POWER ON/OFF SEQUENCE		
8. OPTICAL CHARACTERISTICS	-----	23
8.1 TEST CONDITIONS		
8.2 OPTICAL SPECIFICATIONS		
9. PRECAUTIONS	-----	27
9.1 ASSEMBLY AND HANDLING PRECAUTIONS		
9.2 SAFETY PRECAUTIONS		
10. PACKING	-----	28
10.1 CARTON		
10.2 PALLET		
11. DEFINITION OF LABELS	-----	30
11.1 CMO MODULE LABEL		
11.2 CMO CARTON LABEL		

**Approval**REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver. 3.0	Mar. 23, '09	All	All	Approval Specification was first issued.
Ver. 3.1	Jan. 18, '10	23	8.2	Update value of Min. LAVE from 180 cd/m ² to 187 cd/m ²
Ver. 3.2	May.11, '10	25	10.1	Update packing drawing
		26	10.2	Update packing drawing
		28	11.2	Update carton label



1. GENERAL DESCRIPTION

1.1 OVERVIEW

N173O6 - L02 is a 17.3" TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1600 x 900 HD+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is built in.

1.2 FEATURES

- HD+ (1600 x 900 pixels) resolution
- DE only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- LED

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	382.08 (H) x 214.92 (V) (17.3" diagonal)	mm	(1)
Bezel Opening Area	386.88 (H) x 218.32 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1600 x R.G.B. x 900	pixel	-
Pixel Pitch	0.2388 (H) x 0.2388(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare Type	-	-
Backlight Unit	LEDs 8 strings 8 parallel		
Power Consumption	3.3 typ./ 4.0 max @ Black Pattern, 100nit 60Hz	Watt	
RoHS Compliance	yes		-

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	397.6	398.1	398.6	(1)
	Vertical (V)	232.3	232.8	233.3	
	Depth (D)		5.5	5.8	
Weight		540	555	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

2.1.2 Reliability Test

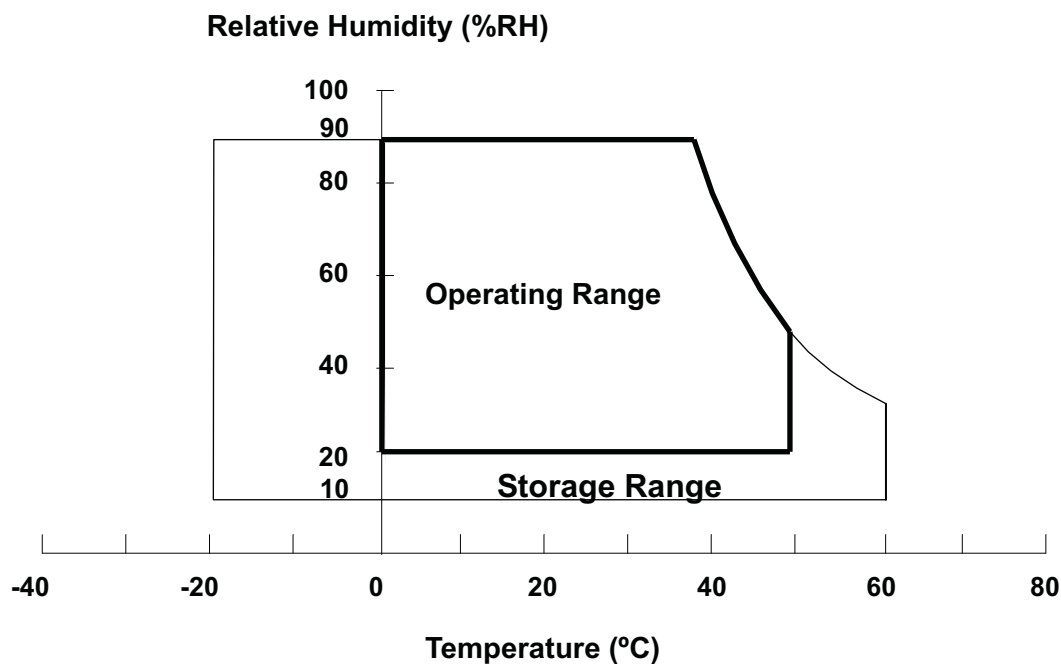
No.	Test Item	Test Condition	Note
1	High Temperature Storage	60°C, 240 hours	(1) (2)
2	Low Temperature Storage	-20°C, 240 hours	
3	Thermal Shock Storage	[(-20°C 30min)→(60°C 30min)]/cycle, 100cycles	
4	High Temperature Operating	50°C, 300 hours	
5	Low Temperature Operating	0°C, 300 hours	
6	High Temperature & High Humidity Operating	50°C, 80% RH, 300hours	
7	High Temperature & High Humidity Storage	40°C, 90% RH, 240hours	
8	Shock (Non-Operating)	220G, 2ms	(3)(5)
9	Vibration (Non-Operating)	1.5G, 10 to 500 Hz	(4)(5)
10	ESD test (Operation)	150pF/330Ω Contact Discharge : ±8KV	(6)
		150pF/330Ω Air Discharge : ±15KV	
11	Connector ESD test(Non-operation) (converter on PCB LED BLU only)	100pF/1.5kΩ Contact Discharge : ±2KV	(6)

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C Min. and 60 °C Max.

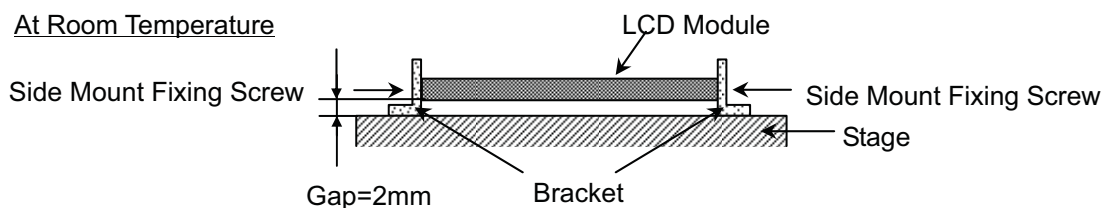


Note (3) 1 time for $\pm X$, $\pm Y$, $\pm Z$. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10 ~ 500 Hz, 30 min/cycle, 1 cycle for each X, Y, Z axis.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



Note (6) According to IEC 61000-4-2



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_I	-0.3	$V_{CC}+0.3$	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
LED Light Bar Power Supply Voltage	V_L	-40	28	V	(1), (2)
LED Light Bar Power Supply Current	I_L	0	200	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

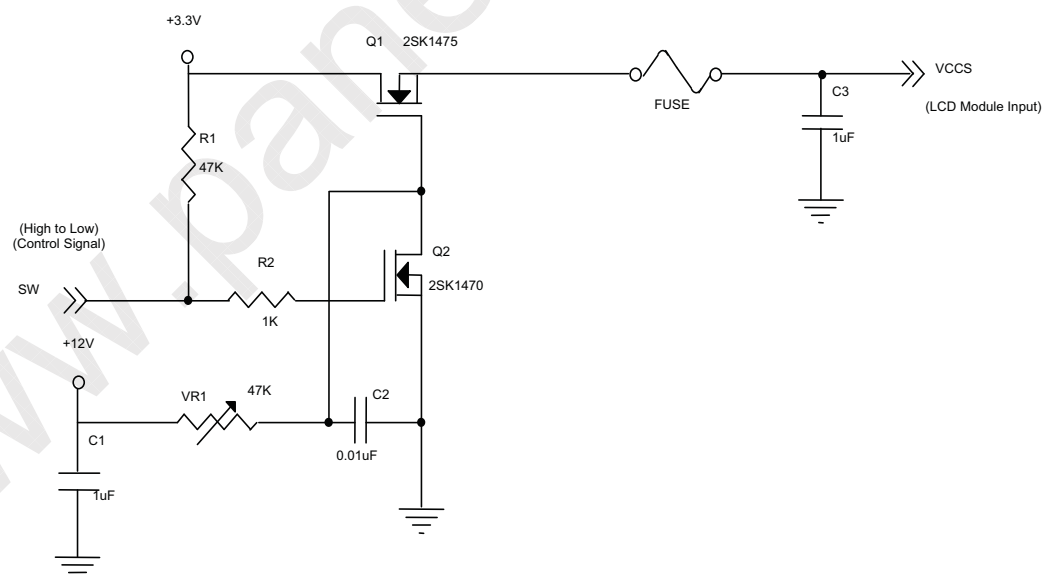
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	3.0	3.3	3.6	V	-
Ripple Voltage		V _{RP}		50		mV	-
Rush Current		I _{RUSH}			1.5	A	(2)
Initial Stage Current		I _{IS}			1.0	A	(2)
Power Supply Current	White	I _{CC}	240	260	300	mA	(3)a
	Black		320	350	390	mA	(3)b
LVDS Differential Input High Threshold		V _{TH(LVDS)}			+100	mV	(4), V _{CM} =1.2V
LVDS Differential Input Low Threshold		V _{TL(LVDS)}	-100			mV	(4) V _{CM} =1.2V
LVDS Common Mode Voltage		V _{CM}	1.125		1.375	V	(4)
LVDS Differential Input Voltage		V _{ID}	100		600	mV	(4)
LVDS Terminating Resistor		R _T		100		Ohm	
Power per EBL WG		P _{FRI}	-	2.02	-	W	(5)

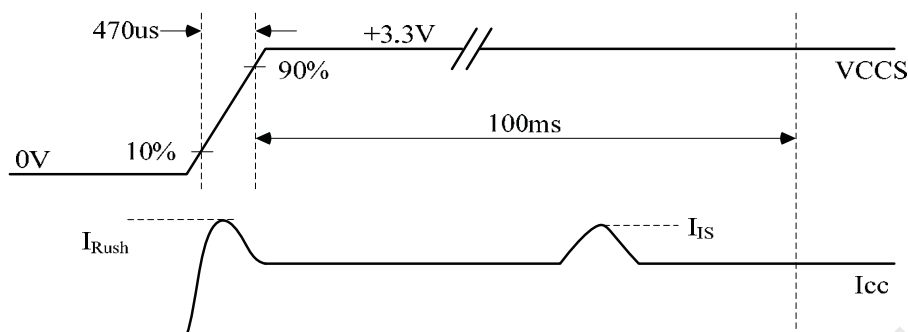
Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



VCCS rising time is 0.5ms

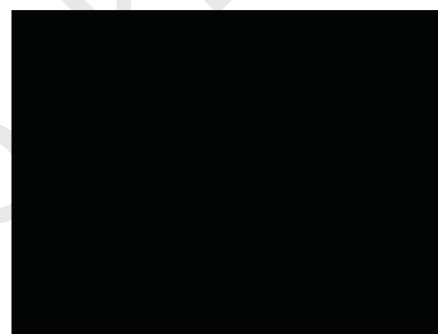
Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, $T_a = 25 \pm 2^\circ\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



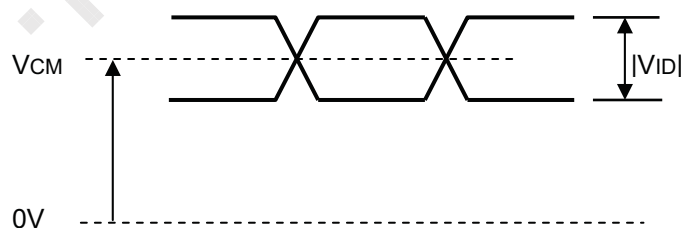
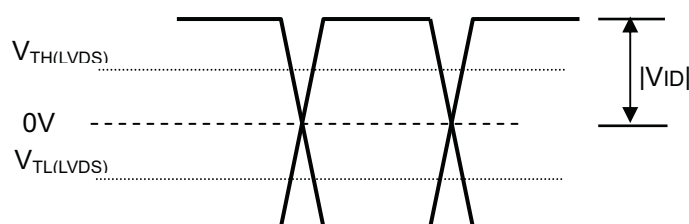
Active Area

b. Black Pattern



Active Area

Note (4) The parameters of LVDS signals are defined as the following figures.

Single Ended**Differential**

Note (5) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

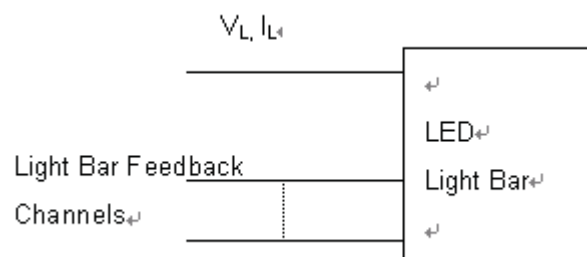
- (a) $V_{CCS} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.

3.2 BACKLIGHT UNIT

$T_a = 25 \pm 2\text{ }^{\circ}\text{C}$

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	22.4	25.6	28	V	(1),(2) (Duty 100%)
LED Light Bar Power Supply Current	I_L	133	140	147	mA	
Power Consumption	P_L	2.97	3.58	4.11	W	(3), $I_L = 140\text{ mA}$ (Duty 100%)
LED Life Time	L_{BL}	15000	-	-	Hrs	(4)

Note (1) LED light bar configuration is shown as below.



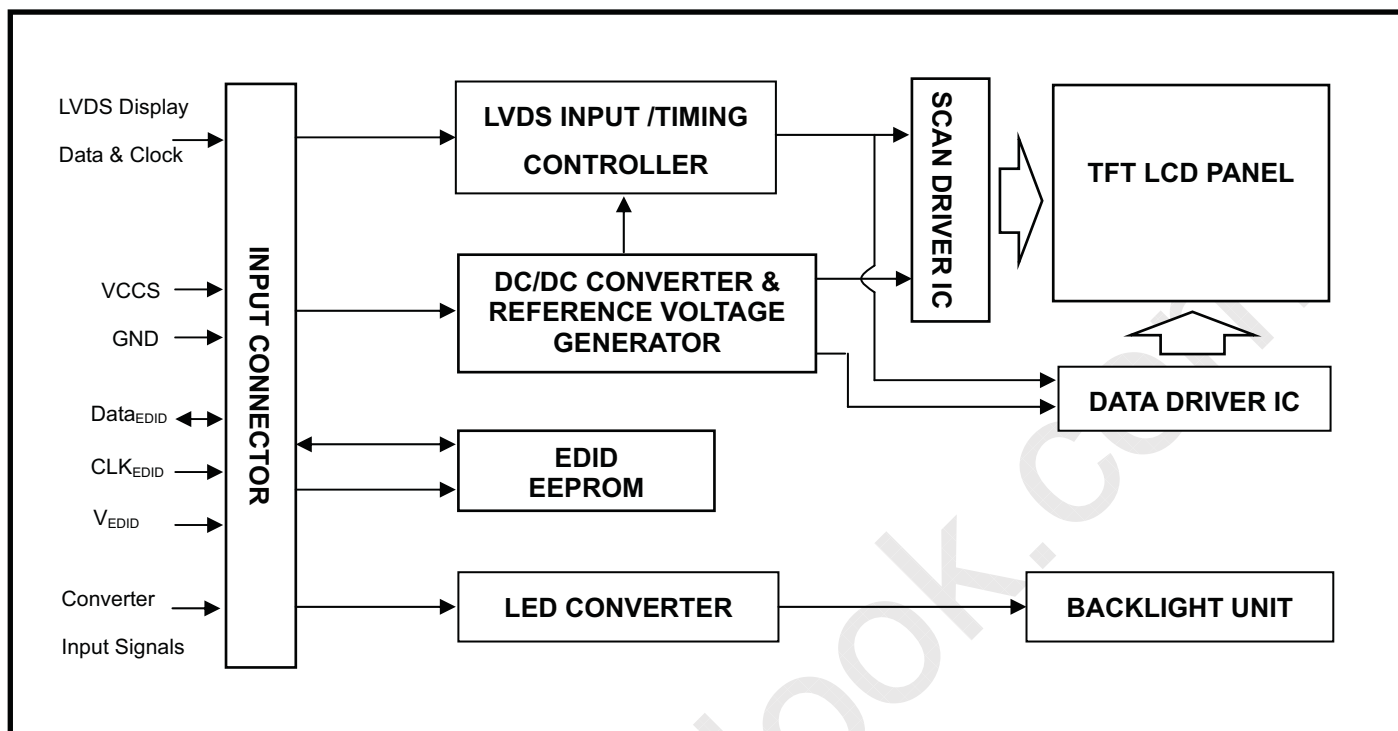
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$, converter efficiency 85%(typ)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ and $I_L = 17.5\text{ mA}$ (Per EA) until the brightness becomes $\leq 50\%$ of its original value.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE





5. INPUT TERMINAL PIN ASSIGNMENT

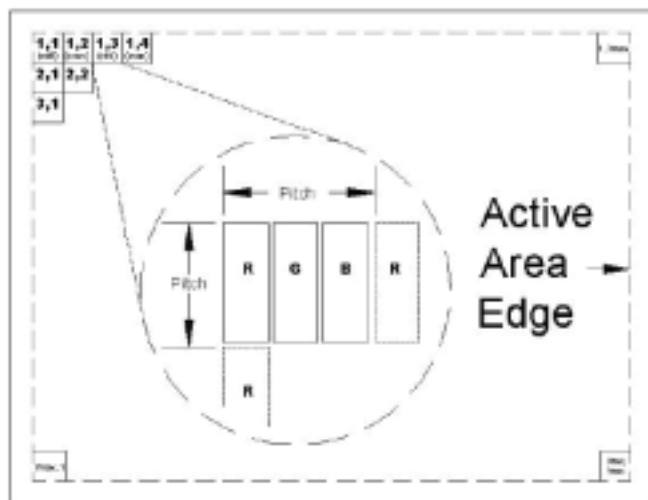
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Non connection		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V _{EDID}	DDC 3.3V Power		
5	Reserve	Non connection use by CMO		
6	CLK _{EDID}	DDC Clock		
7	DATA _{EDID}	DDC Data		
8	RX00-	LVDS Differential Data Input (Odd)	Negative	
9	RX00+	LVDS Differential Data Input (Odd)	Positive	
10	Vss	Ground		
11	RX01-	LVDS Differential Data Input (Odd)	Negative	
12	RX01+	LVDS Differential Data Input (Odd)	Positive	
13	Vss	Ground		
14	RX02-	LVDS Differential Data Input (Odd)	Negative	
15	RX02+	LVDS Differential Data Input (Odd)	Positive	
16	Vss	Ground		
17	RXOC-	LVDS Clock Data Input (Odd)	Negative	
18	RXOC+	LVDS Clock Data Input (Odd)	Positive	
19	Vss	Ground		
20	RxE0-	LVDS Differential Data Input (Even)	Negative	
21	RxE0+	LVDS Differential Data Input (Even)	Positive	
22	Vss	Ground		
23	RxE1-	LVDS Differential Data Input (Even)	Negative	
24	RxE1+	LVDS Differential Data Input (Even)	Positive	
25	Vss	Ground		
26	RxE2-	LVDS Differential Data Input (Even)	Negative	
27	RxE2+	LVDS Differential Data Input (Even)	Positive	
28	Vss	Ground		
29	RXEC-	LVDS Clock Data Input (Even)	Negative	
30	RXEC+	LVDS Clock Data Input (Even)	Positive	
31	GND	Ground		
32	LED_GND	LED Ground		
33	LED_GND	LED Ground		
34	Reserve	No Connection use by CMO		
35	LED_PWM	System PWM Signal Input		
36	LED_EN	LED enable pin		
37	Reserve	No Connection use by CMO		
38	LED_VCCS	LED Power		
39	LED_VCCS	LED Power		
40	LED_VCCS	LED Power		

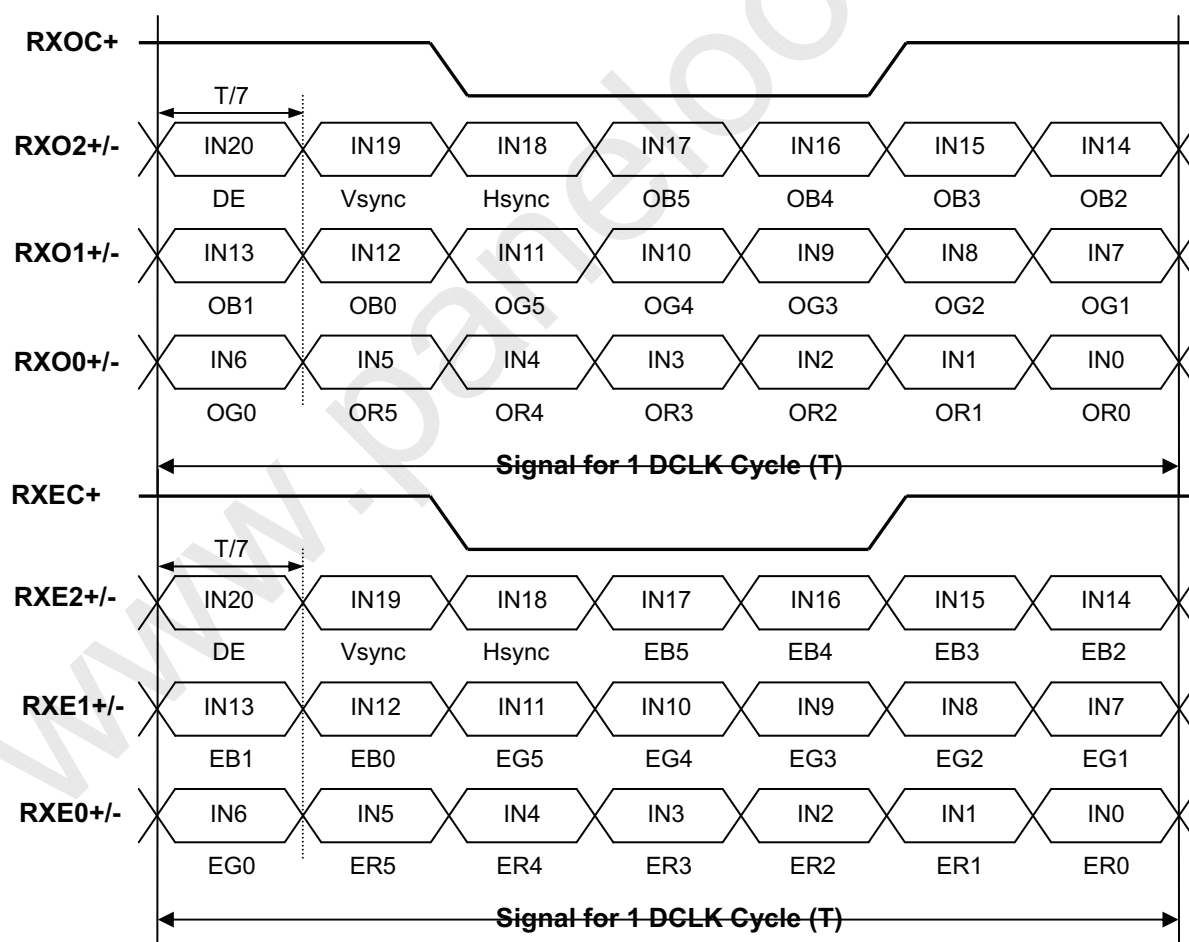
Note (1) Connector Part No.: I-PEX 20455-040E-12

Note (2) User's connector Part No: I-PEX 20453-040T-01 or equivalent

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL





5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage



5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N173O6-L02)	11	00010001
11	0B	ID product code (hex LSB first; N173O6-L02)	17	00010111
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "00H")	05	00000101
17	11	Year of manufacture (fixed "00H")	13	00010011
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("38.768cm")	27	00100111
22	16	Max V image size ("21.852cm")	16	00010110
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	06	00000110
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	35	00110101
27	1B	Red-x (Rx = "0.617")	9E	10011110
28	1C	Red-y (Ry = "0.336")	56	01010110
29	1D	Green-x (Gx = "0.321")	52	01010010
30	1E	Green-y (Gy = "0.596")	98	10011000
31	1F	Blue-x (Bx = "0.16")	29	00101001
32	20	Blue-y (By = "0.081")	14	00010100
33	21	White-x (Wx = "0.313")	50	01010000
34	22	White-y (Wy = "0.329")	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

**Approval**

42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("97.75MHz", According to VESA CVT Rev1.1)	2F	00101111
55	37	# 1 Pixel clock (hex LSB first)	26	00100110
56	38	# 1 H active ("1600")	40	01000000
57	39	# 1 H blank ("160")	A0	10100000
58	3A	# 1 H active : H blank ("1600 : 160")	60	01100000
59	3B	# 1 V active ("900")	84	10000100
60	3C	# 1 V blank ("26")	1A	00011010
61	3D	# 1 V active : V blank ("900 : 26")	30	00110000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("32")	20	00100000
64	40	# 1 V sync offset : V sync pulse width ("3 : 5")	35	00110101
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48: 32 : 3 : 5")	00	00000000
66	42	# 1 H image size ("382 mm")	7E	01111110
67	43	# 1 V image size ("215 mm")	D7	11010111
68	44	# 1 H image size : V image size ("382 : 215")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N173O6-L02", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name ("N")	4E	01001110
78	4E	# 2 2nd character of name ("1")	31	00110001
79	4F	# 2 3rd character of name ("7")	37	00110111
80	50	# 2 4th character of name ("3")	33	00110011
81	51	# 2 5th character of name ("O")	4F	01001111
82	52	# 2 6th character of name ("6")	36	00110110
83	53	# 2 7th character of name ("-")	2D	00101101
84	54	# 2 8th character of name ("L")	4C	01001100
85	55	# 2 9th character of name ("0")	30	00110000

**Approval**

86	56	# 2 9th character of name ("2")	32	00110010
87	57	# 2 New line character indicates end of ASCII string	0A	00001010
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name"N173O6-L02", ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("1")	31	00110001
115	73	# 4 3rd character of name ("7")	37	00110111
116	74	# 4 4th character of name ("3")	33	00110011
117	75	# 4 5th character of name ("O")	4F	01001111
118	76	# 4 6th character of name ("6")	36	00110110
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 9th character of name ("2")	32	00110010
123	7B	# 4 New line character indicates end of ASCII string	0A	00001010
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	2F	00101111

6. CONVERTER SPECIFICATION

6.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Ratings
LED_VCCS	-0.3~28V
LED_PWM	-0.3V~5.5V
LED_EN	-0.3V~5.5V

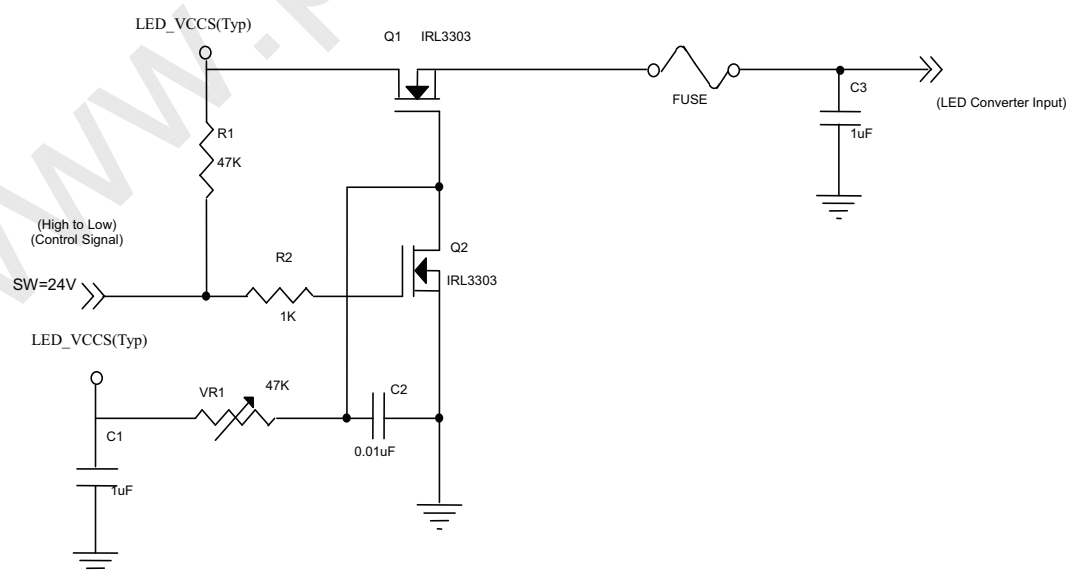
6.2 RECOMMENDED OPERATING RATINGS

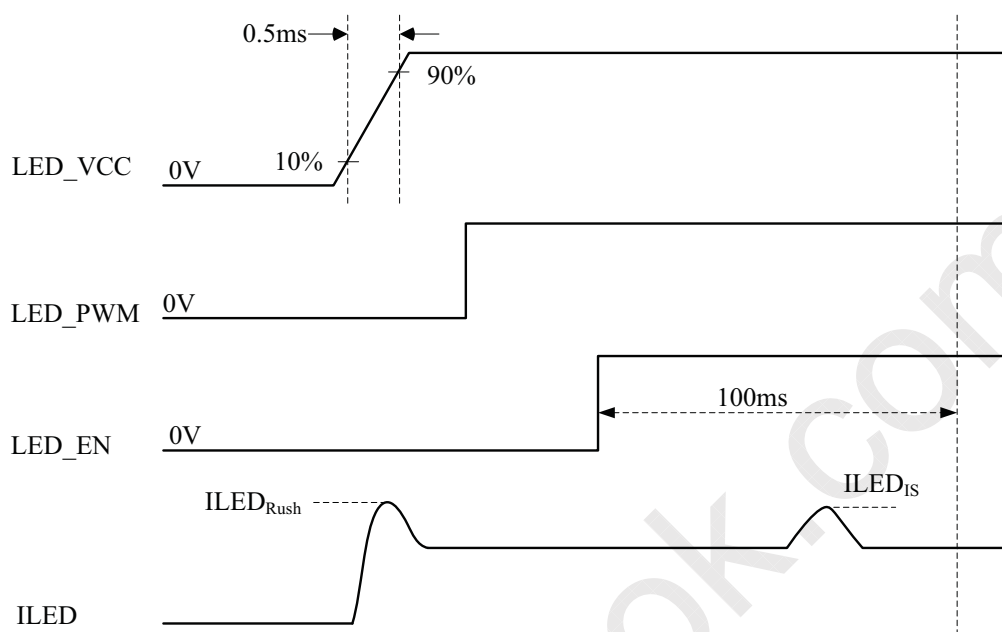
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Input power supply voltage	LED_Vccs	6	12.0	21.0	V	-
Converter Rush Current	I _{LED_RUSH}	-	-	1.5	A	(1)
Converter Initial Stage Current	I _{LED_IS}	-	-	1.5	A	(1)
EN Control Level	Backlight On	2	-	5	V	-
	Backlight Off	0	-	0.8	V	-
PWM Control Level	PWM High Level	2	-	5	V	-
	PWM Low Level	0	-	0.15	V	-
PWM Control Duty Ratio		10	-	100	%	-
		5	-	100	%	(2)
PWM Control Permissive Ripple Voltage	V _{PWM_pp}	-	-	100	mV	-
PWM Control Frequency	f _{PWM}	190	210	1K	Hz	(3)
LED Power Current	LED_VCCS =Min.	552	703	858	mA	(4)
	LED_VCCS =Typ.	276	351	429	mA	(4)
	LED_VCCS =Max.	158	201	245	mA	(4)

Note (1) I_{LED_RUSH}: the maximum current when LED_VCCS is rising,

I_{LED_IS}: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.



VLED rising time is 0.5ms

Note (2) If the PWM control duty ratio is less than 10%, there is some possibility that acoustic noise or backlight flash can be found. And it is also difficult to control the brightness linearity.

Note (3) If PWM control frequency is applied in the range less than 1KHz, the “waterfall” phenomenon on the screen may be found. To avoid the issue, it's a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N + 0.33) * f \leq f_{PWM} \leq (N + 0.66) * f$$

N : Integer ($N \geq 3$)

f : Frame rate

Note (4) The specified LED power supply current is under the conditions at “LED_VCCS = Min., Typ., Max.”,
 $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$, $f_{PWM} = 200 \text{ Hz}$, Duty=100%.

7. INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

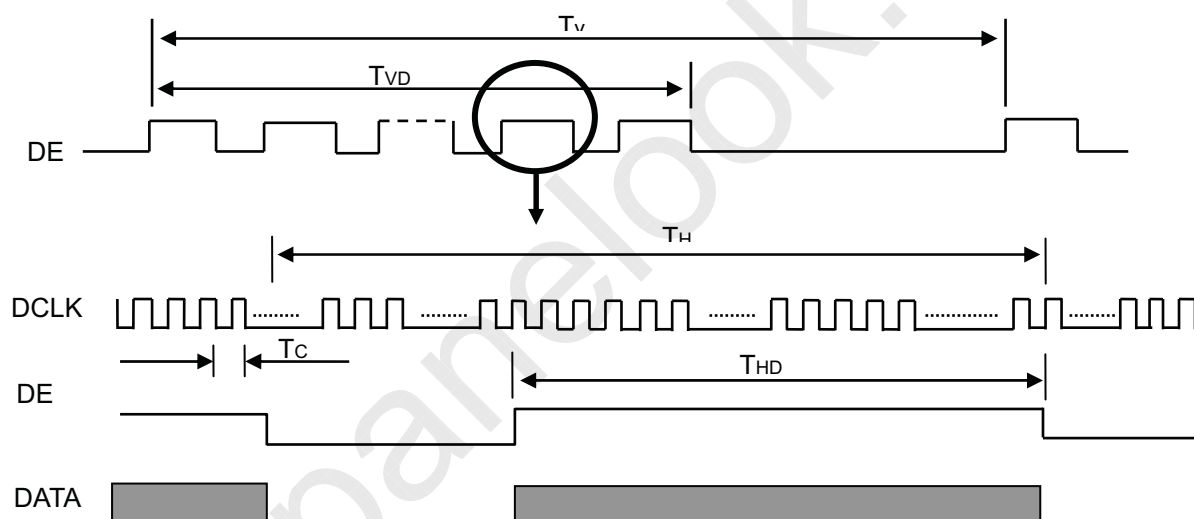
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	44	48.9	51.4	MHz	(2)
DE	Vertical Total Time	TV	903	926	1157	TH	-
	Vertical Active Display Period	TVD	900	900	900	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	26	TV-TVD	TH	
	Horizontal Total Time	TH	1682	1760	2200	Tc	(2)
	Horizontal Active Display Period	THD	1600	1600	1600	Tc	(2)
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	(2)

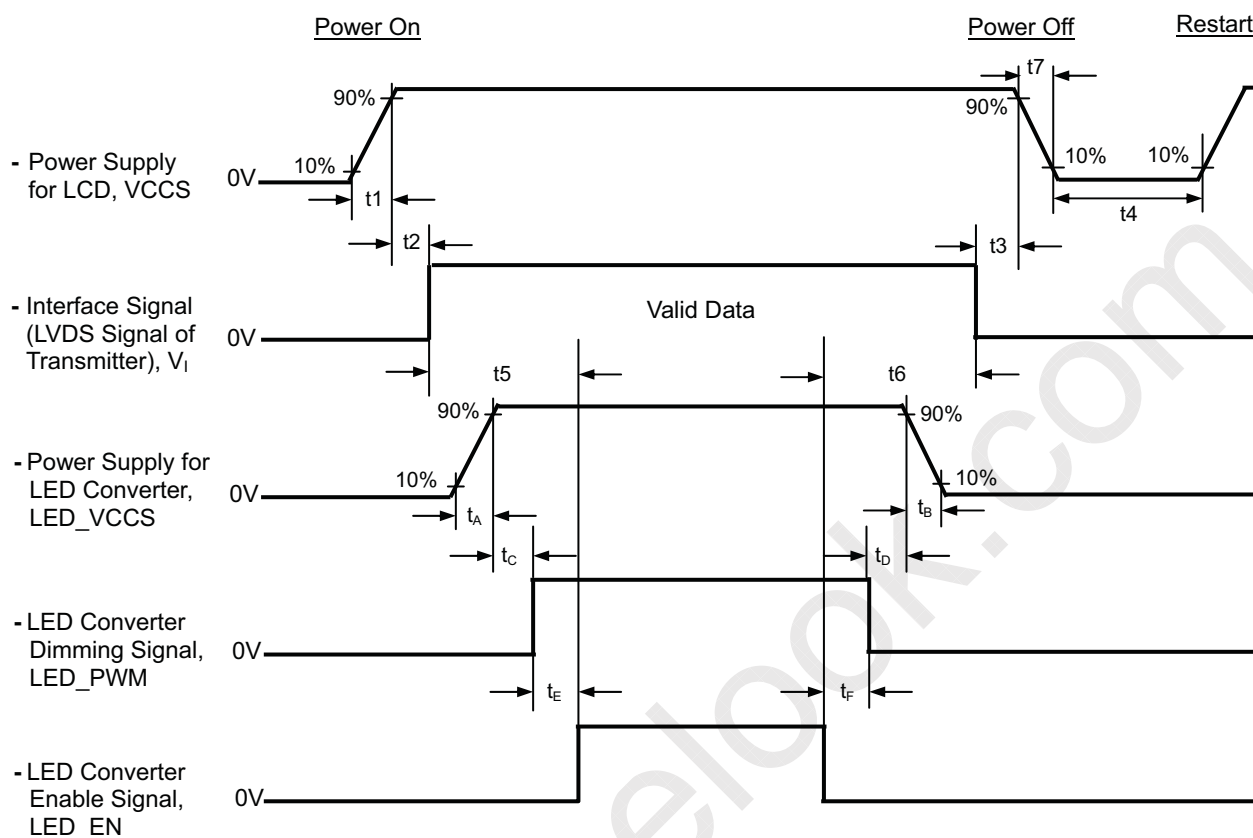
Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) 2 channels LVDS input.

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0.5 \leq t_1 \leq 10 \text{ ms}$$

$$0 \leq t_2 \leq 50 \text{ ms}$$

$$0 \leq t_3 \leq 50 \text{ ms}$$

$$t_4 \geq 500 \text{ ms}$$

$$t_5 \geq 200 \text{ ms}$$

$$t_6 \geq 200 \text{ ms}$$

$$0.5 \leq t_7 \leq 10 \text{ ms}$$

$$0.5 \leq t_A \leq 10 \text{ ms}$$

$$0 < t_B \leq 10 \text{ ms}$$

$$t_C \geq 10 \text{ ms}$$

$$t_D \geq 10 \text{ ms}$$

$$t_E \geq 10 \text{ ms}$$

$$t_F \geq 10 \text{ ms}$$

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD VCCS to 0 V.

Note (3) The backlight must be turned on after the power supply for the logic and the interface signal is valid. The backlight must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Please follow the LED converter power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller



8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

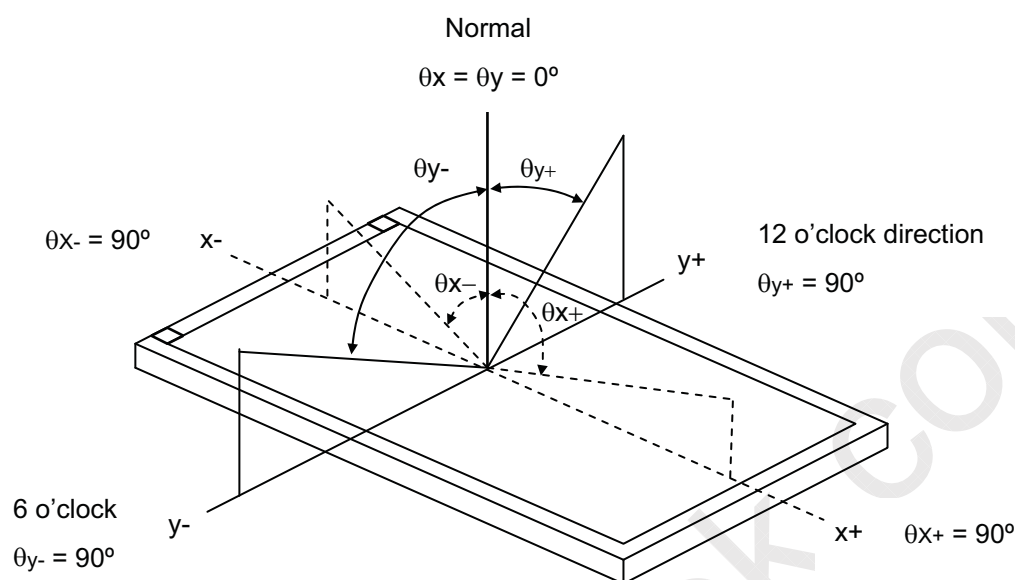
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Lightbar power supply Current	I _L	140	mA

The relative measurement methods of optical characteristics are shown in 8.2. The following items should be measured under the test conditions described in 8.1 and stable environment shown in Note (5).

8.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	R _x	θ _x =0°, θ _y =0° CS-2000T	Typ – 0.03	0.613	Typ + 0.03		(1), (5),(7)
		R _y			0.344			
	Green	G _x			0.326			
		G _y			0.59			
	Blue	B _x			0.160			
		B _y			0.082			
	White	W _x			0.313			
		W _y			0.329			
Average Luminance of White		L _{AVE}		187	220	---	cd/m ²	(4), (5),(7)
Contrast Ratio		CR		500	650	---	-	(2), (5),(7)
Response Time		T _R	θ _x =0°, θ _y =0°	---	2	8	ms	(3),(7)
		T _F		---	6	12	ms	
White Variation		δW	θ _x =0°, θ _y =0°	70	80	--	-	(5), (6),(7)
Viewing Angle	Horizontal	θ _x +	CR ≥ 10	40	45	---	Deg.	(1), (5),(7)
		θ _x -		40	45	---		
	Vertical	θ _y +		15	20	---		
		θ _y -		40	45	---		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

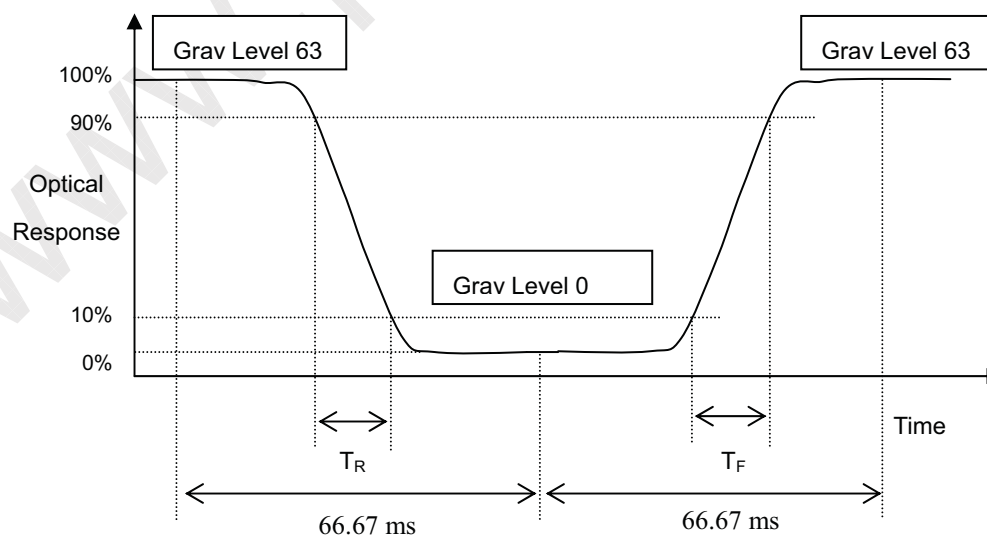
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (1)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

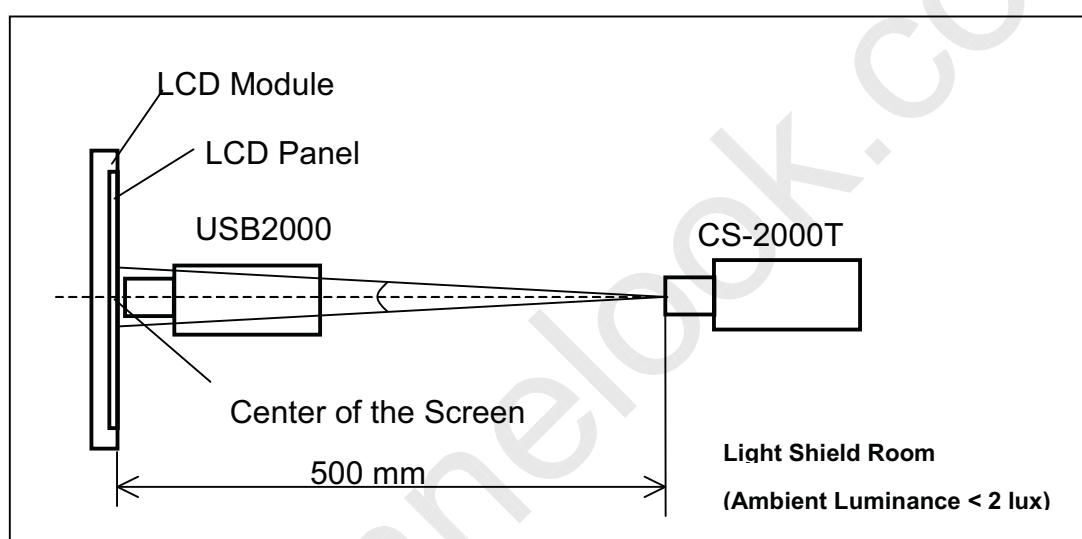
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

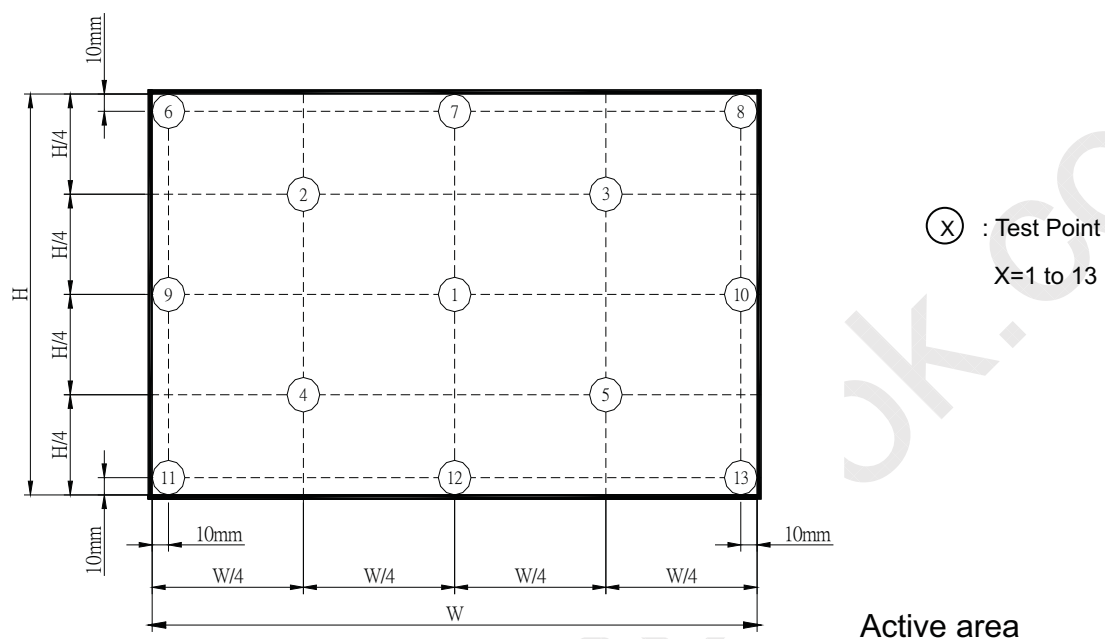
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W = \{ \text{Minimum } [L(1) \sim L(5)] / \text{Maximum } [L(1) \sim L(5)] \}$$



Note(7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

9.2 SAFETY PRECAUTIONS

- (1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

10. PACKING

10.1 CARTON

- (1) Box Dimensions : 490(L)*350(W)*320(H) mm
- (2) 20 modules/Carton

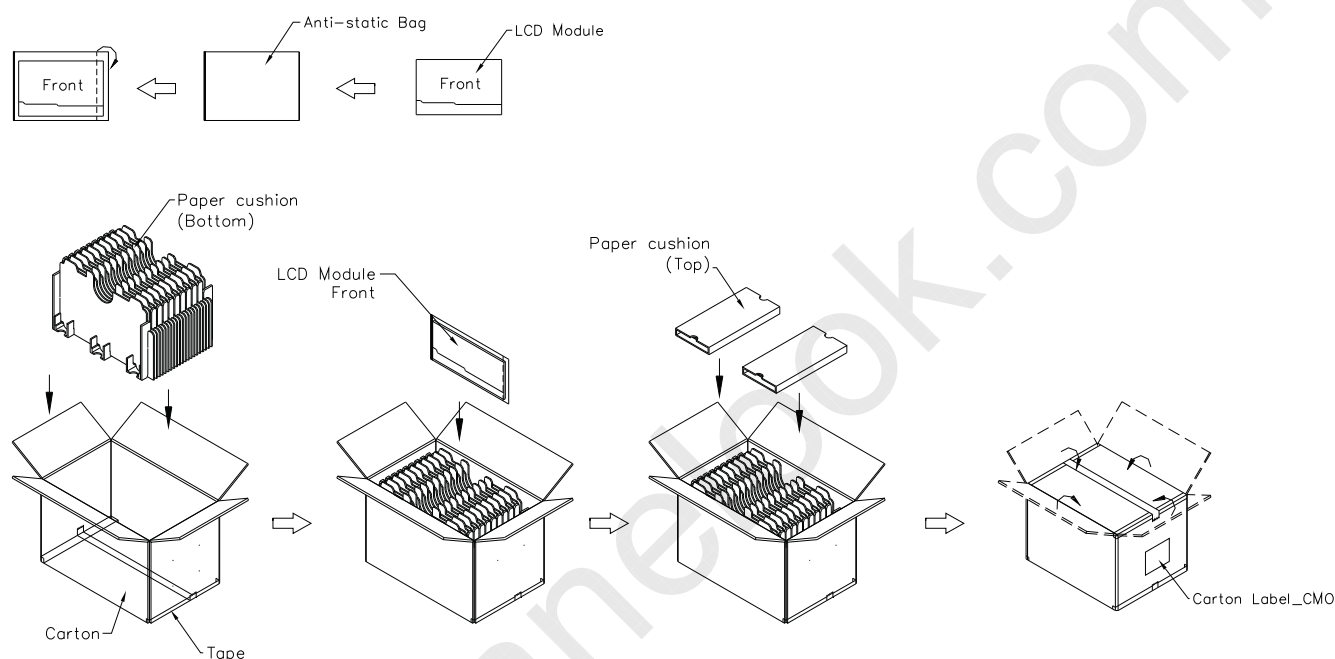


Figure. 10-1 Packing method



10.2 PALLET

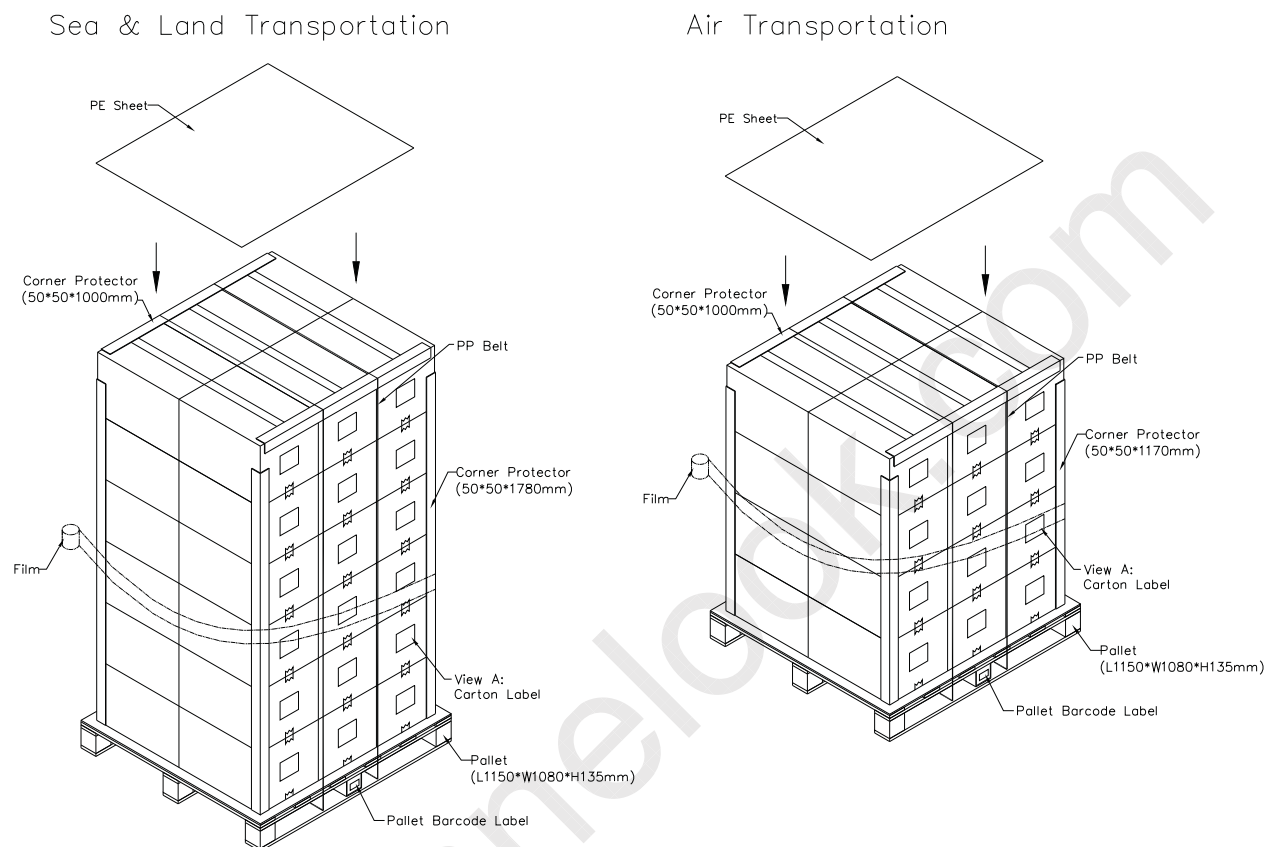


Figure. 10-2 Packing method

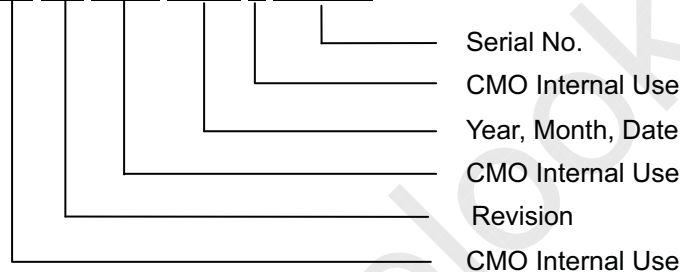
11. DEFINITION OF LABELS

11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: N173O6 - L02
- (b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.
- (c) Serial ID: XXXXXXYMDXXXX




- (d) Production Location: MADE IN XXXX. XXXX stands for production location.
- (e) UL logo: LEOO especially stands for panel manufactured by CMO NingBo satisfying UL requirement.
The panel without LEOO mark stands for manufactured by CMO Taiwan satisfying UL requirement.

Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product

11.2 CMO CARTON LABEL

PO.NO.	_____
Part ID.	_____
Model Name	N173O6-L02
Carton ID.	_____
Quantities	20
	

(a) Production location: Made In XXXX. XXXX stands for production location.



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